PATENT SPECIFICATION

655,467

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COMPLETE SPECIFICATION

Improvements in or relating to Packings for Pistons and the like.

We, SOCIETE D'INVENTIONS AERONAUTIQUES ET MECANIQUES S.I.A.M., of 6, rue de la Rotisserie, Geneva, Switzerland, a Corporate body organised under the laws of the Confederation of Switzerland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention comprises improvements in or relating to packings for pistons and the like, and relates to high-pressure gland-, piston-, or like part, packings of the type comprising a pair of relatively movable co-operating members sliding one within the other, of which one member has an annular groove extending around its inner or outer periphery which accommodates a deformable resilient packing ring, the construction being such as to provide for the application of pressure, for example fluid pressure, to a side-face of the ring to squeeze the ring against the far side of the groove thereby deforming the ring radially so as to cause it to press against the second member of the pair.

According to the present invention a high pressure gland-, piston-, or like part, packing of the type described is characterised in that the deformable resilient packing ring is tapered or chamfered to an edge, or almost to an edge, where it bears on the second member of the pair; thus the area of sealing contact between the packing ring and said second member of the pair of relatively movable members is only a very narrow area, as compared with that obtained when the packing ring is of the usual kind which is not chamfered and where the width of the area of contact is substantially equal to the full width of the ring.

In the terms annular groove and packing ring are included any groove or packing ring which has in plan view the general form of a closed ring, but may have any configuration other than circular, such as polygonal, according to the form of the co-operating members moving relatively to one another to which the packing is applied.

The present invention provides a packing in which the friction at the sealing surface of the packing ring is greatly reduced during relative movement of the movable members, and especially at the commencement of such movement, since the narrow surface of contact is more readily kept lubricated than the wider sealing surface of an unchamfered ring by reason of the lesser distance along which the lubricating fluid is required to penetrate and the greater mobility of the sealing tip of the ring. Whereas unchamfered rings in packings of the type described frequently show a tendency to stick at commencement of movement, sticking of the chamfered ring is virtually non-existent owing to the narrow area of contact and the ability of the sealing tip of the ring to flex or distort slightly as it is set in motion.

Moreover, packing rings for high pressure seals have hitherto frequently exhibited a tendency during operation to extrude axially into the narrow clearance gap between the relatively movable members, and the provision of chamfered rings overcomes this difficulty.

These advantages are obtained in packings according to the invention without loss of the toughness and resiliency of the body of the packing ring which features are of prime importance in ensuring that the packing will function satisfactorily under high pressure; in fact tests carried out by us show that the fluid-tightness of the packing is not materially affected by the chamfering of the packing ring.

It has been known previously to provide sealing rings which are reduced in section toward their sealing surface, but these have been for low pressure oil seals provided

normally with garter springs to hold the rings in sealing contact, whereas the present invention relates specifically to high pressure packings of the type described.

Preferably each side of the packing ring is chamfered to an equivalent extent so that the ring is symmetrical about a plane perpendicular to the direction of relative movement of the co-operating members; thus the packing to movement is substantially the same in either direction.

The grooved member may be formed with passages to allow access of fluid pressure to a side-face of the packing ring, or alternatively the pressure may be applied by a helical compression spring.

In British Patent Specification No. 481762 there is described a high pressure duplex packing ring which comprises two solid, elastic and continuous rings fitting one inside the other one of which rings has an interior diameter somewhat smaller than the exterior diameter of the other ring such that the ring which ensures a fluid-tight joint receives a radial pressure from the other ring and is thus pressed against the piston, cylinder or other element with which it makes sealing contact; packings according to the present invention are preferably provided with duplex rings of this kind. Also, as described in Patent Specification No. 481,762, the ring which ensures a fluid-tight joint and receives a radial pressure from the other ring is preferably made from harder material than the other ring.

Various embodiments of the invention are illustrated by way of example in the accompanying drawings in which:—

Fig. 1 is a cross section of a packing according to the invention,

Fig. 2 is a partial plan view of the same packing,

Fig. 3 is a longitudinal section of a piston with packings according to the invention,

Figs. 4 to 6 are fragmentary views showing modified methods of fitting the said packings to pistons.

Fig. 7 shows the packing employed in place of a normal stuffing box, and

Fig. 8 shows, on a larger scale the action of the packing when the movable part is set in motion.

A packing ring 1, which consists of rubber or other resilient material affording the appropriate degree of flexibility, has in plan view the general form of a circle but could have any configuration other than circular, such as polygonal, according to the form of the parts moving relatively to one another to which the packing is applied.

The sides of the ring are chamfered adjacent to the sliding or active edge 2 of the packing so that the said active edge is in theory reduced to a line and is in practice a very narrow strip when pressed into contact with the wall with respect to which it is movable relatively.

Fig. 3 shows the application of packings in accordance with the invention to a double-acting piston 3 which is arranged to move in a cylinder 4, and the two faces of which are in contact with a layer of liquid (immersed piston) as in hydraulic jacks.

The packing rings, of which there are two, are lodged in grooves 5 in the piston and the pressure obtaining in either of the chambers 6 and 7 of the cylinder is exerted on one packing ring or the other through ducts 8 connecting the grooves housing the packing rings to the said chambers. The packing rings 1 are shown as occupying the whole width of their grooves in the axial direction, but it will be appreciated that fluid pressure applied through the ducts 8 will cause contraction axially and extension radially of the rings so that, in fact, during operation the rings have a slight axial clearance.

In the example shown in Fig. 4, these ducts are omitted, but a slight clearance 9 is left between the packing ring and the sides of the groove in which it is lodged and this allows fluid to enter from the cylinder chamber and exert pressure on the packing ring.

The examples shown in Figs. 5 and 6 correspond to Figs. 3 and 4 respectively with regard to the means for delivering pressure into the grooves in which the packing rings are lodged, but they show a combination of two packing rings in each groove, that is to say a principal packing ring 1 with the chamfer 2 according to the invention, and an auxiliary packing ring 10 which is disposed inside the principal packing ring, and consists of softer rubber than the principal packing ring. The auxiliary packing ring 10 has an exterior diameter slightly greater than the interior diameter of the principal packing ring 1, and therefore serves to impart thereto a slight permanent extension ensuring close contact of the principal packing ring with the cylinder, in the manner known *per se* from British Patent No. 481,762.

In the example shown in Fig. 7, the packing, comprising a packing ring 11, acts as a stuffing box with respect to the rod 12 of the piston 13 movable in the cylinder 14. In this case, the chamfer, here designated by the reference numeral 15, is situated on the inner periphery of the ring, and the ring is in slight compression in the axial direction under the action of a spring 16. The axial compression produces a corresponding slight radial extension of the ring sufficient to urge the chamfer 15 against

the piston rod and prevent leakage.

Fig. 8 shows the action of a packing according to the invention at the beginning of the movement of the movable part, the said movable part being in this example the piston rod 12, while the packing ring is retained in the fixed part. When the piston rod is stationary, the chamfer 2 bears against the said rod over a narrow compression zone 17, the neutral axis of the packing ring occupying the position 18—19. As soon as the piston rod commences to move, for example in the direction of the arrow *f*, the nose of the chamfer undergoes a sideways distortion which brings the said axis into the position 18—20, the chamfer then assuming the form shown in dot-and-dash lines, from which it will be seen that the height of the zone of compression and consequently the surface over which the packing ring bears against the movable part decreases, to a point where the movable part is set in motion substantially without friction between it and the packing ring. It will be seen that the friction at the commencement, which is very considerable in the case of packings of other types having a cylindrical active edge, by reason of the "sticking" of the said packing, is reduced to a minimum in the present case owing to the slight distortion or rocking of the packing ring.

During continued movement of the movable member the pressure of the fluid set in motion is exerted on the packing ring and causes it to undergo a slight extension, while the neutral axis resumes its normal position, the nose of the chamfer again being slightly compressed against the surface in contact with it, thus ensuring effective fluid-tightness while bringing about, by reason of the chamfered form, as aforedescribed, a considerable reduction in the frictional forces as compared with packings of known type having a cylindrical active edge.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A high-pressure gland-, piston-, or like part, packing ring of the type described, characterised in that the deformable resilient packing ring is tapered or chamfered to an edge, or almost to an edge, where it bears on the second member of the relatively movable pair, for the purpose described.

2. A packing as claimed in Claim 1, wherein each side of the packing ring is chamfered to an equal extent so that the ring is symmetrical about a plane perpendicular to the direction of relative movement of the co-operating members.

3. A packing as claimed in Claim 1 or Claim 2, wherein the groove which accommodates the packing ring is dimensioned to afford limited rocking movement or distortion of the ring in an axial direction for the purpose described.

4. A packing as claimed in Claim 1 or Claim 2, or Claim 3, wherein the grooved member is formed with passages to allow access of fluid pressure to a side-face of the packing ring.

5. A packing as claimed in Claim 1 or Claim 2 or Claim 3, wherein the pressure is applied to a side face of the packing ring by a helical compression spring.

6. A packing as claimed in any one of the preceding claims wherein the packing ring is a duplex ring comprising two solid, elastic end continuous rings fitting one inside the other, one of which rings has an interior diameter somewhat smaller than the exterior diameter of the other ring, such that the ring which ensures a fluid-tight joint receives a radial pressure from the other ring and is thus pressed against the piston, cylinder or other element with which it makes sealing contact.

7. A packing as claimed in Claim 6, wherein the ring which receives a radial pressure from the other ring is made from harder material than the other ring.

8. A packing ring, for use in a high pressure packing of the type described, substantially as described herein with reference to, and as shown in, Figs. 1, 2 and 8 or Figs. 5 and 6 of the accompanying drawings.

9. A high pressure packing substantially as described with reference to, and as shown in, Figs. 3 and 5 or Figs. 4 and 6 or Fig. 7 of the accompanying drawings.

Dated this 20th day of February, 1948.

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FIG.1.

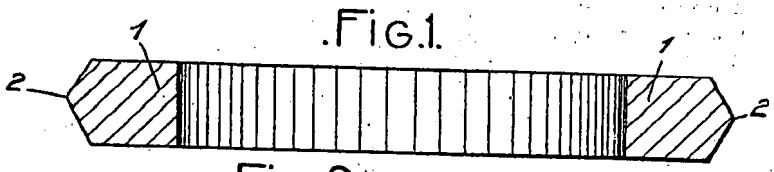


FIG.2.

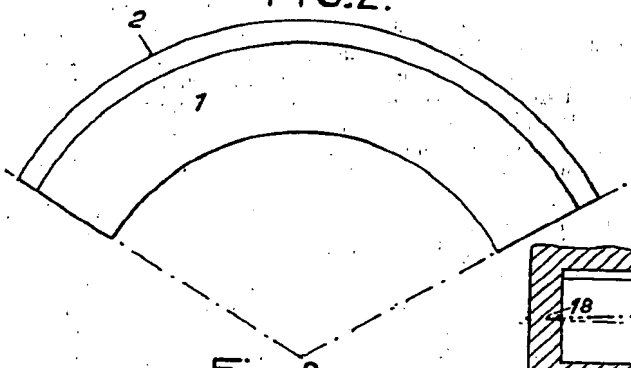


FIG.8.

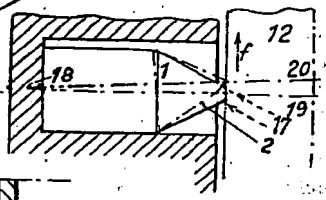


FIG.3.

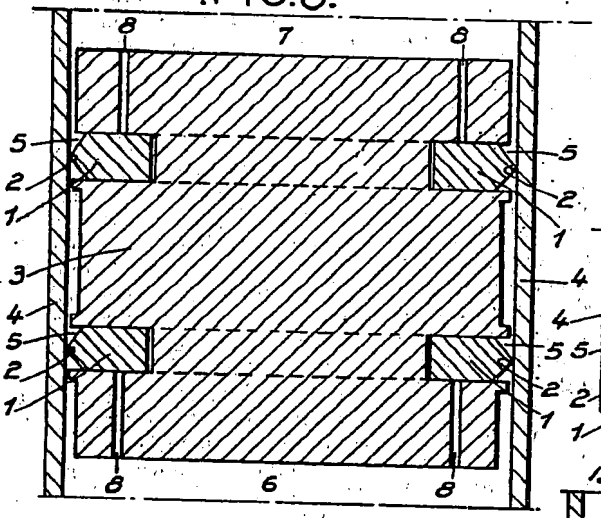


FIG.4.

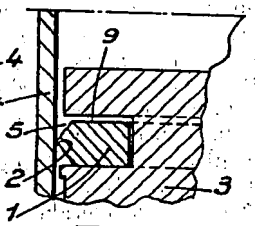


FIG.5.

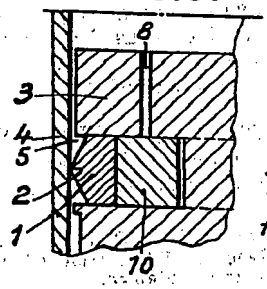


FIG.6.

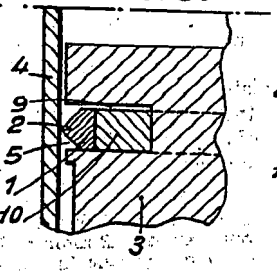
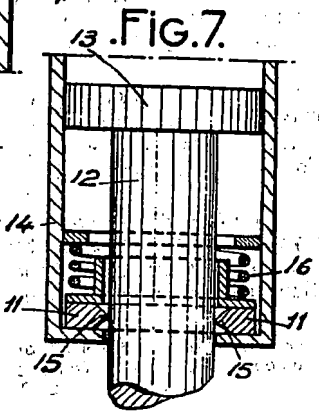


FIG.7.



H.M.S.O. (M.F.P.)